# PATENT ABSTRACTS OF JAPAN

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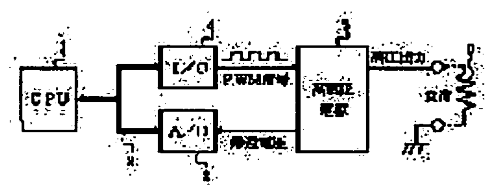
## (54) POWER SUPPLY EMPLOYING PWM CONTROL SYSTEM

(57)Abstract:
PURPOSE: To obtain a power supply excellent in rising characteristics and steady characteristics by employing different output voltage control factors at the time of rising and during steady operation.
CONSTITUTION: An I/O interface 4 is connected with a high voltage power supply 5 generating a different high voltage depending on the pulse duty of a PWM signal and an output from the high voltage power supply 5 is applied to a load 6. The output voltage from the high voltage power supply 5 is stepped down and fed, as a feedback voltage signal, to an A/D converter 3. When the difference between a feedback voltage and a target feedback voltage is sufficiently small, the value of an output voltage control factor (OC) is equalized to a basic gain by a CPU 1 using an acceleration gain regulating constant. When the square of the difference exceeds the acceleration gain regulating constant, the acceleration gain increases over 2 and the OC varies depending on the product of acceleration gain and basic gain. The acceleration gain varies gradually in the region where the difference is relatively small and the variation increases as the difference increases.

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CLAIMS

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[Claim(s)]
[Claim 1] The power unit using the PWM control system characterized by to have a 1st armature-voltage-control means change and control said factor for output-voltage control by the time of a standup until it reaches said target electrical-potential-difference value, and the stationary after reaching said target electrical-potential-difference value in the power unit using the PWM control system which performs armature-voltage control which makes an actual output-voltage value in agreement with a target electrical-potential-difference value using the factor for output-voltage control.
[Claim 2] The power unit using the PWM control system according to claim 1 which starts said factor for output voltage control from the time of a stationary, and is characterized by having a 2nd armature-voltage control means to sometimes enlarge and to control.
[Claim 3] The power unit using the PWM control system according to claim 1 characterized by having a 3rd armature-voltage control means to control an output voltage value using the factor for output voltage control which compared the target electrical-potential-difference value with the fed-back actual output voltage value, and was called for based on this comparison result.
[Claim 4] Said 3rd armature-voltage control means is a power unit using the PWM control system according to claim 3 characterized by enlarging the factor for output voltage control and controlling it, so that the difference of said target electrical-potential-difference value and the fed-back actual output voltage value is large.

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[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the power unit using the PWM control system which started the power unit which used the PWM control system, especially made good the both sides of a rising characteristic and a stationary characteristic.
[0002]
[Description of the Prior Art] The power unit using PWM control as equipment which generates the conventional, for example, direct current, high voltage is known. This type of power unit has the description that control of output voltage is easy and tends to stabilize output voltage. It is desirable to define a factor for output voltage control (control gain) which is satisfied with the power unit using this PWM control system of each of the rising characteristic immediately after an injection of an electric power switch and the stationary characteristic after predetermined time passes, and to perform armature-voltage control.
[0003]
[Problem(s) to be Solved by the Invention] However, it could necessarily be satisfied with neither of power unit using the conventional PWM control system of both the properties of a rising characteristic and a stationary characteristic. That is, the rising characteristic was getting worse, although the stationary characteristic became good when the value of the factor for output voltage control was conversely made small by a stationary characteristic worsening, although the rising characteristic became good when the value of the factor for output voltage control was enlarged.
[0004] Then, it is made in order that this invention may solve such a technical problem, and a rising characteristic and both the properties of a stationary characteristic set it as the purpose of each invention to offer the power unit using a good PWM control system.
[0005]
[Means for Solving the Problem] In the power unit using the PWM control system which performs armature-voltage control which makes an actual output voltage value in agreement with a target electrical-potential-difference value in invention according to claim 1 using the factor for output voltage control in an PWM control system It has a 1st armature-voltage control means to change and control said factor for output voltage control by the time of a standup until it reaches said target direct-current-voltage value, and the stationary after reaching said target electrical-potential-difference value, and the 1st purpose is attained. It has a 2nd armature-voltage control means to start from the time of a stationary, to sometimes enlarge said factor for output voltage control, and to control by invention according to claim 2, and the 2nd purpose is attained.
[0006] In invention according to claim 3, a target electrical-potential-difference value is compared with the fed-back actual output voltage value, it has a 3rd armature-voltage control means to control an output voltage value using the factor for output voltage control called for based on this comparison result, and the 3rd purpose is attained. In invention according to claim 4, said 3rd armature-voltage control means attains the 4th purpose by enlarging the factor for output voltage control and controlling it, so that the difference of said target electrical-potential-difference value and the fed-back actual output voltage value is large.
[0007]
[Function] With the power unit using an PWM control system according to claim 1, the 1st armature-voltage control means changes the factor for output voltage control, and controls output voltage by the time of a standup until it reaches a target electrical-potential-difference value, and the stationary after reaching said target

electrical-potential-difference value. The 2nd armature-voltage control means starts, makes the factor for output voltage control at the time larger than the factor for output voltage control at the time of a stationary, and controls output voltage by the power unit using an PWM control system according to claim 2. The 3rd armature-voltage control means compares the desired value of the electrical-potential-difference value which a power unit generates with the electrical-potential-difference value which said fed-back power unit generated, asks for the factor for output voltage control based on this comparison result, and controls output voltage by the power unit using an PWM control system according to claim 3. Said 3rd armature-voltage control means enlarges the factor for output voltage control, and controls output voltage by the power unit using an PWM control system according to claim 4, so that the difference of said target electrical-potential-difference value and feedback voltage value is large.

[0008]

[Example] Hereafter, one example in the power unit using the PWM control system of this invention is explained to a detail with reference to drawing 1 thru/or drawing 5 . The bus line 2 which consists of a data bus etc. is connected to CPU1 which is the "1st and 3rd armature-voltage control means" as shown in drawing 1 , and the I/O interface 4 which sends out the PWM signal generated by CPU1 is connected with A/D converter 3 which changes into a digital signal the feedback voltage signal (feedback signal) explained to the degree which consists of an analog signal at the bus line 2. The I/O interface 4 is connected to the high-voltage power source 5 which generates the high voltage which changes with magnitude of the pulse duty of an PWM signal, and the high-voltage output outputted from the high-voltage power source 5 is impressed to a load 6. The electrical potential difference generated with the high-voltage power source 5 is decompressed, and is inputted into A/D converter 3 as a feedback voltage signal.

[0009] Next, actuation of the example constituted in this way is explained.

** The main routine of the control algorithm which generates the PWM signal for performing armature-voltage control processing to main routine drawing 2 is shown. When there are no activation directions of armature-voltage control processing, the output of an PWM signal is forbidden (step 1;Y), an electrical-potential-difference PWM phase angle timer value is made into the minimum value, the output of armature-voltage control PWM is turned OFF (step 5), and processing is ended. In step 1, when there are activation directions of armature-voltage control processing, an PWM signal is outputted (step 1; N), and when timing (control timing) for electrical-potential-difference PW modification processing to control by already ending is not suitable, (step 2; N) and processing are ended. Moreover, in step 2, electrical-potential-difference PW modification processing is unsettled, when control timing is suitable, it recognizes that (step 2;Y) electrical-potential-difference PW modification processing was completed (step 3), when target electrical-potential-difference data are "0", a (step 4;Y) electrical-potential-difference PWM phase angle timer value is made into the minimum value, the output of armature-voltage control PWM is turned OFF (step 5), and processing is ended. In step 4, when target electrical-potential-difference data are not "0", the subroutine (armature-voltage control PW value modification processing) shown in (step 4; N) and drawing 3 is performed (step 6), and processing is ended. The above processing is processing at the time of directions of armature-voltage control processing activation.

[0010] ** The flow chart of a subroutine (armature-voltage control PW value modification processing) is shown in subroutine (armature-voltage control PW value modification processing) drawing 3 . This subroutine is an algorithm which calculates the updating value of an electrical-potential-difference PWM phase angle timer. As shown in drawing 3 R> 3, a feedback electrical-potential-difference value is beyond a target feedback electrical-potential-difference value (step 11;Y), when a feedback electrical-potential-difference value is larger than a target feedback electrical-potential-difference value, the difference of (step 12; N), a feedback electrical-potential-difference value, and a target feedback electrical-potential-difference value is calculated (step 13), and the subroutine (count of an armature-voltage control PW control input) shown in drawing 4 is performed (step 14). And the count result of an armature-voltage control PW control input is added to an old electrical-potential-difference PWM phase angle timer value (step 15). However, an electrical-potential-difference PWM phase angle timer value is restricted to an armature-voltage control PW upper limit (step 16), and ends processing so that maximum of an armature-voltage control PW value may not be exceeded.

[0011] Moreover, in step 11, when a feedback electrical-potential-difference value is smaller than a target feedback electrical-potential-difference value, the difference of (step 11; N), a feedback electrical-potential-difference value, and a target feedback electrical-potential-difference value is calculated (step 17), and the

subroutine (count of an armature-voltage control PW control input) shown in drawing 4 is performed (step 14). And the count result of an armature-voltage control PW control input is subtracted from an old electrical-potential-difference PWM phase angle timer value (step 18). However, an electrical-potential-difference PWM phase angle timer value is restricted to an armature-voltage control PW lower limit (step 19), and ends processing so that it may not become under the minimum value of an armature-voltage control PW value.
[0012] ** a subroutine (count of an armature-voltage control PW control input) -- this subroutine -- the difference of a feedback electrical-potential-difference value and a target feedback electrical-potential-difference value -- it is the algorithm which was made to enlarge the value of the factor for output voltage control, so that a value is large. difference -- "1" is added to the value which squared the value (= feedback electrical-potential-difference value-target feedback electrical-potential-difference value), and divided the result by the acceleration gain tone integer constant, and the acceleration gain of armature-voltage control is searched for (step 21). This acceleration gain searched for is made below into the maximum of the acceleration gain of armature-voltage control, and prepares a upper limit (step 22). subsequently, the value which multiplied the calculated acceleration gain value by basic gain (= acceleration gain / difference value) (step 23), and was further calculated at step 23 -- difference -- it multiplies by the value and considers as the value of an electrical-potential-difference PW control input (step 24). The minimum value of the calculated armature-voltage control PW control input is restricted in a upper limit (step 25), and PW value and PW control input are memorized (step 26).
[0013] namely, -- according to this algorithm -- a steady state -- difference -- when a value is sufficiently small, with an acceleration gain tone integer constant, the operation of step 21 is set to "1" and the value of the factor for output voltage control becomes equal to the value of basic gain. difference -- if the square of a value serves as a value more than an acceleration gain tone integer constant, acceleration gain will become two or more values, and the factor for output voltage control will also change based on the value of the product of acceleration gain and basic gain. acceleration gain -- difference -- since it is calculated based on the square operation of a value -- difference -- the field where a value is comparatively small -- acceleration gain -- **** -- changing -- difference -- the amount of value changes of acceleration gain also becomes large as a value becomes large.
[0014] Therefore, in a steady state, fine control is possible, when the time of the standup of an electrical potential difference and desired value are changed, the factor for output voltage control changes dynamically, and the time amount to which output voltage reaches a target electrical potential difference becomes short. Moreover, also when output voltage shifts from a target electrical potential difference, PW value is controlled by the proper factor value for output voltage control according to the value shifted by disturbance etc., and it can return to a target electrical-potential-difference value early according to it. the difference at the time of making the upper limit of an acceleration gain tone integer constant, basic gain, and acceleration gain, and the upper limit of PW control input into a proper value at drawing 5 -- the relation of the control input of the acceleration gain over a value and PW value is shown. Drawing 5 (a) shows relation when an acceleration gain tone integer constant is set to 16 and it sets [ basic gain ] the upper limit of 10 and PW control input to 255 for the upper limit of 1/8 and acceleration gain. Moreover, drawing 5 (b) shows relation when an acceleration gain tone integer constant is set to 4 and it sets [ basic gain ] the upper limit of 8 and PW control input to 255 for the upper limit of 1/8 and acceleration gain. for example, it is shown in drawing 5 (a) -- as -- the difference of a target electrical potential difference and a feedback electrical potential difference -- case a value is large -- (for example, 50) the factor for output voltage control -- large -- carrying out (acceleration gain being set as 6) -- said difference -- when a value is small (for example, 10), the factor for output voltage control is made small (acceleration gain is set as 1).
[0015]
[Effect of the Invention] As explained above, according to invention according to claim 1, start, are changing the factor for output voltage control in the time and the time of a stationary, and according to invention according to claim 2 Start from the time of a stationary, sometimes enlarge the factor for output voltage control, and according to invention according to claim 3 Since it asks for the factor for output voltage control based on the comparison with desired value and a feedback value, and according to invention according to claim 4 the factor for output voltage control is enlarged so that the difference of desired value and a feedback value is large The power unit which was excellent in the property at the time of a property and a stationary at the time of a

standup can be offered.

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DRAWINGS

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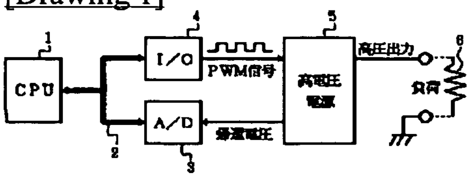
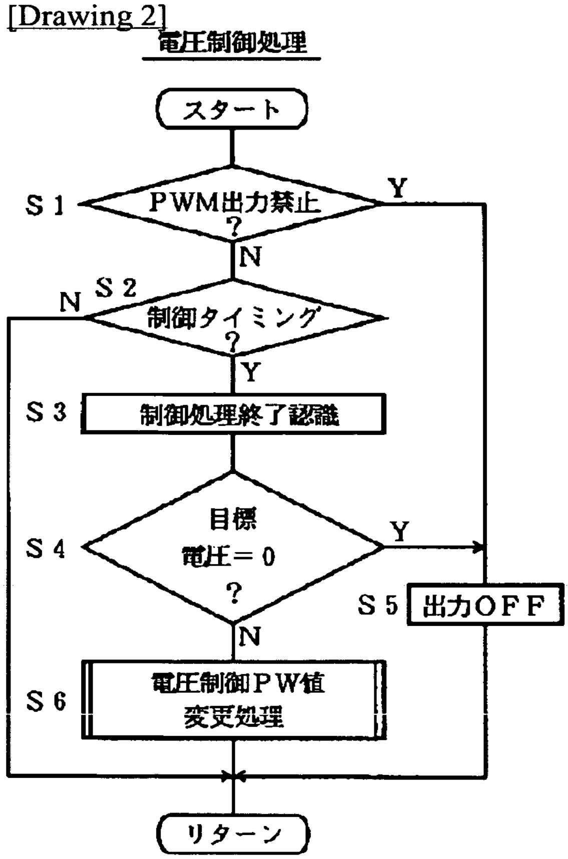
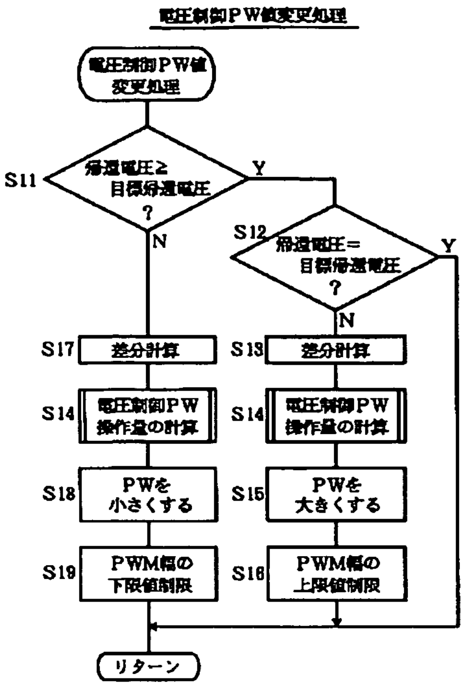
[Drawing 1]



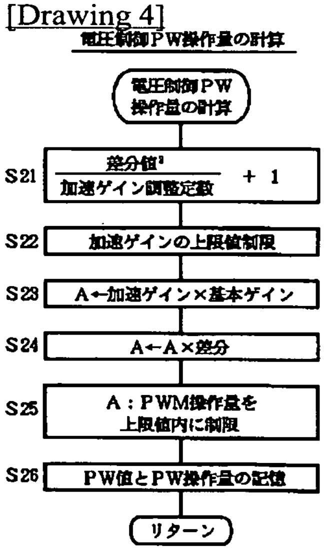

[Drawing 2]




[Drawing 3]

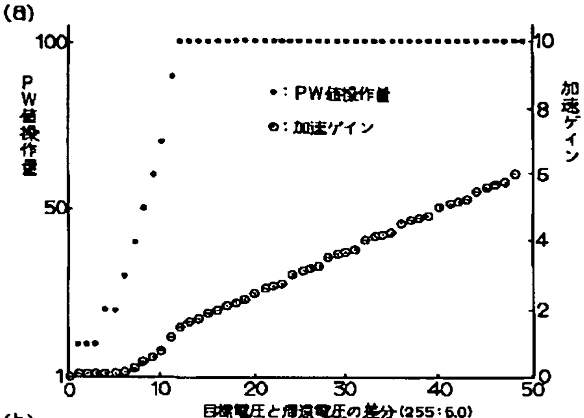



[Drawing 4]

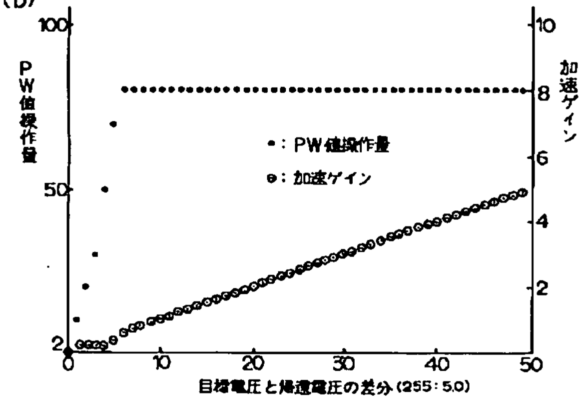



[Drawing 5]

(a)




(b)

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